WHAT IS CLAIMED IS:

1. A method for additive mask repair in the semiconductor industry with fine control over lateral dimensions and height comprising:

depositing material to a defective mask by direct write nanolithography from a tip for additive repair.

2. The method according to claim 1, wherein the defective mask comprises an optically transparent substrate containing thereon a mask layer which is an optically opaque pattern.

3. The method according to claim 1, wherein the defective mask is a phase shifting photomask.

4. The method according to claim 1, wherein the defective mask is an EUV lithography mask, an electron projection lithography mask, an x-ray lithography mask, or an ion projection lithography mask.

5. The method according to claim 1, wherein the defective mask is for nanoimprint lithography.

6. The method according to claim 1, wherein the defective mask comprises an opaque defect.

7. The method according to claim 1, wherein the defective mask comprises a clear defect.

8. The method according to claim 1, wherein the defective mask comprises a nanometer scale opening to which the material is added.

9. The method according to claim 1, wherein the defective mask comprises an opening having a lateral dimension of less than about 100 nm to which the material is added.

10. The method according to claim 1, wherein the defective mask comprises an opening having a lateral dimension of less than about 80 nm to which the material is added.

11. The method according to claim 1, wherein the defective mask comprises an opening having a lateral dimension of less than about 56 nm to which the material is added.

12. The method according to claim 1, wherein the defective mask comprises an opening having a lateral dimension of less than about 35 nm to which the material is added.

13. The method according to claim 1, wherein the mask comprises a feature of about 100 nm or less in lateral dimension which is repaired.

14. The method according to claim 1, wherein the tip is a scanning probe microscope tip.

15. The method according to claim 1, wherein the tip is an atomic force microscope tip.

16. The method according to claim 1, wherein the tip is a hollow tip.

17. The method according to claim 1, wherein the material is an optically transparent material.

18. The method according to claim 1, wherein the material is an optically opaque material.

19. The method according to claim 1, wherein the material is applied as multiple layers.

20. The method according to claim 1, wherein the material is applied to a height of at least 30 nm.

21. The method according to claim 1, wherein the material is applied to a height of at least 45 nm.

22. The method according to claim 1, wherein the material is applied to a height of at least 100 nm.

23. The method according to claim 1, wherein the material is applied to a height of at least 150 nm.

24. The method according to claim 1, wherein the material is a sol-gel material.

25. The method according to claim 1, wherein the material is a metal oxide or glass, or precursors thereof.

26. The method according to claim 1, wherein the material is a metallic material or a metallic precursor.

27. The method according to claim 1, wherein the material is an opaque carbon material or a precursor therefor.

28. The method according to claim 1, wherein the material comprises nanoparticles.

29. The method according to claim 1, wherein the material comprises one or more high molecular weight compounds.

30. The method according to claim 1, wherein the material has similar optical properties to the pattern to which it is added.

31. The method of claim 1, wherein the adding step is carried out without vacuum conditions.

32. The method of claim 1, wherein the adding step is repeated with the same material.

33. The method of claim 1, wherein the adding step is repeated with different materials.

34. The method of claim 1, further comprising one or more post-adding steps comprising external heating, light irradiation, sonic excitation, or chemical reaction by exposure to a vapor or liquid.

35. The method according to claim 1, wherein the adding step is carried out as one of a series of adding steps carried out with a plurality of tips.

36. The method according to claim 1, further comprising subtracting material from the defective mask.

37. The method according to claim 1, wherein the subtracting of material is carried out with use of a tip.

38. The method according to claim 1, wherein the subtracting of material is carried out with use of a scanning probe microscope tip.

39. The method according to claim 1, wherein the subtracting of material is carried out with use of an atomic force microscope tip.

40. A method for nanolithography comprising: (1) providing a mask, (2) providing a scanning probe microscope tip, wherein the tip is coated with a patterning compound, (3) contacting the coated tip with the mask so that the compound is applied to the mask.

41. The method according to claim 40, wherein the tip is an atomic force microscope tip.

42. The method according to claim 40, wherein the tip is a hollow tip.

43. The method according to claim 40, wherein the patterning compound is a sol-gel material.

44. The method according to claim 40, wherein the patterning compound comprises a metal.

45. The method according to claim 40, wherein the contacting step is repeated to form a multilayer structure.

46. The method according to claim 40, further comprising subtracting material from the mask.

47. A method for nanolithography comprising: (1) providing a substrate having at least one defect, (2) providing a tip with a patterning compound, (3) using the tip with the substrate so that the compound is applied to the substrate at the defect to repair the defect.

48. The method according to claim 47, wherein the tip is an atomic force microscope tip.

49. The method according to claim 47, wherein the tip is a hollow tip.

50. The method according to claim 47, wherein the patterning compound is a sol-gel material or a metal.

51. A method for mask fabrication comprising adding material to a substrate to form a mask by direct write nanolithography with use of a scanning probe microscopic tip to pattern material on the substrate.

52. The method according to claim 51, wherein the tip is an atomic force microscope tip.

53. The method according to claim 51, wherein the tip is a hollow tip.

54. The method according to claim 51, wherein the material is an opaque material.

55 The method according to claim 51, wherein the material is a transparent material.

56. The method according to claim 51, wherein the material comprises a metal.

57. The method according to claim 51, wherein the mask is a photomask.

58. The method according to claim 51, wherein the mask is an EUV lithography mask, an electron projection lithography mask, an x-ray lithography mask, or an ion projection lithography mask.

59. The method according to claim 51, wherein the material is patterned on the substrate to a height of at least 10 nm.

60. The method according to claim 51, wherein the material is patterned on the substrate to a height of at least 100 nm.

61. A method for nanolithography comprising using a coated atomic force microscope tip to deposit a patterning compound on a substrate in mask fabrication.

62. The method according to claim 61, wherein the mask is a mask for nanolithography.

63. The method according to claim 61, wherein the patterning compound is deposited to a height of at least 100 nm.

64. The method according to claim 61, wherein the material is a sol-gel material or a metal.

65. The method according to claim 61, wherein the patterning compound is deposited more than once to form a multi-layered deposit.

66. A method of nanolithography comprising using a tip to layer one or more patterning compounds on a substrate so the one or more patterning compounds form a structure at least about 10 nm high.

67. The method according to claim 66, wherein the structure is a mask enhancement structure.

68. The method according to claim 66, wherein the structure is at least about 45 nm high.

69. The method according to claim 66, wherein the structure is at least about 100 nm high.

70. The method according to claim 66, wherein the structure is about 10 nm to about 250 nm high.

71. The method according to claim 66, wherein the structure is a single layer.

72. The method according to claim 66, wherein the structure comprises multiple layers.

73. The method according to claim 66, wherein the compounds are sol-gel compounds or metallic compounds.

74. A repaired mask prepared by the method of claim 1.

75. A repaired mask prepared by the method of claim 40.

76. A repaired mask prepared by the method of claim 47.

77. A mask fabricated by the method of claim 51.

78. A mask fabricated by the method of claim 61.

79. Method of use of a scanning probe microscope to repair a mask by additive repair.

80. The method of use according to claim 79, wherein the scanning probe microscope is an atomic force microscope.

81. Method of use of an scanning probe microscope to prepare a mask by additive lithography.

82. The method of use according to claim 81, wherein the scanning probe microscope is an atomic force microscope.

83. A method comprising the steps of:

inspecting an object by making SPM measurement of the object with a first SPM probe;

repairing the object by adding material to the object's material with the first SPM probe or with a second SPM probe,

wherein the adding of material is carried out by direct write nanolithographic printing by transfer of the material from the probe tip to the object.

84. A repaired mask comprising:

a defective mask substrate comprising at least one nanometer-scale opening which is a defect;

at least one additive repair nanostructure at least partially filling the opening.

85. The mask according to claim 84, wherein the nanostructure substantially fills the opening.

86. The mask according to claim 84, wherein the nanometer scale opening has a lateral dimension of about 100 nm or less.

87. The mask according to claim 84, wherein the nanometer scale opening has a lateral dimension of about 80 nm or less.

88. The mask according to claim 84, wherein the nanometer scale opening has a lateral dimension of about 56 nm or less.

89. The mask according to claim 84, wherein the nanometer scale opening has a depth of about 500 nm or less.

90. The mask according to claim 84, wherein the nanometer scale opening has a depth of about 100 nm or less.

91. The mask according to claim 84, wherein the additive repair structure is a sol-gel structure.

92. The mask according to claim 84, wherein the additive repair structure is a metallic structure.

93. The mask according to claim 84, wherein the additive repair structure is a carbon structure.

94. The mask according to claim 84, wherein the additive repair structure is substantially the same material as the mask substrate.

95. The mask according to claim 84, wherein the additive repair structure is a different material from the mask substrate.

96. A single layer nanostructure having a height of at least 100 nm and a lateral dimension of about 200 microns or less.

97. A multiple layer nanostructure having a height of at least 100 nm and a lateral dimension of about 200 microns or less.